

What is claimed is:

1. A method of at least partially filling at least one microfluidic channel of a microfluidic device with a gas or fluid, the method comprising:

5 applying a vacuum to the at least one microfluidic channel of the microfluidic device; and

 at least partially filling the at least one microfluidic channel with at least one of a gas or fluid while the at least one microfluidic channel remains under vacuum.

10 2. The method of claim 1 wherein the applying a vacuum to the at least one microfluidic channel of the microfluidic device comprises placing the microfluidic device in a vacuum chamber.

15 3. The method of claim 2 further comprising applying a vacuum to the vacuum chamber.

 4. The method of claim 3 wherein applying a vacuum comprises applying a vacuum between about 0 and 102 kPa.

20 5. The method of claim 3 wherein applying a vacuum comprises applying a vacuum between about 15 and 85 kPa.

 6. The method of claim 3 wherein applying a vacuum comprises applying a vacuum between about 30 and 70 kPa.

25 7. The method of claim 3 wherein applying a vacuum comprises applying a vacuum between about 45 and 55 kPa.

30 8. The method of claim 3 wherein applying a vacuum comprises applying a vacuum between about 0 and 5 kPa.

9. The method of claim 1 wherein said at least partially filling comprises at least partially filling the at least one microfluidic channel with a degassed fluid comprising a buffer.

5 10. The method of claim 1 wherein the at least partially filling the at least one microfluidic channel with a gas or fluid comprises at least partially filling the at least one microfluidic channel with at least one fluid selected from the group comprising: water, EDTA solution, DMSO, PEG, polyacrylamide, and NaOH solution.

10 11. The method of claim 1 wherein said at least partially filling comprises diffusing a fluid into the at least one microfluidic channel.

12. The method of claim 1 wherein the at least one microfluidic channel is fluidly connected to an at least one capillary element, which element includes a capillary channel disposed therein.

15 13. The method of claim 1 wherein the at least one microfluidic channel comprises a plurality of microfluidic channels.

20 14. The method of claim 13 wherein the plurality of microfluidic channels are fluidly coupled to one or more micro-reservoirs.

15. The method of claim 1 wherein the at least partially filling comprises at least partially filling the at least one microchannel with at least one inert gas.

25 16. The method of claim 15 wherein the at least one inert gas is selected from the group comprising carbon dioxide and nitrogen.

30 17. The method of claim 1 wherein said at least partially filling the at least one microfluidic channel comprises at least partially filling the microfluidic channel with both a gas and a fluid.

18. A method of preparing at least one microfluidic device for a gas or fluid-filling operation comprising placing the at least one microfluidic device in a vacuum chamber and applying a vacuum to the vacuum chamber.

5 19. The method of claim 18 comprising placing two or more microfluidic devices in the vacuum chamber.

10 20. The method of claim 18 further comprising introducing at least one of a gas or a fluid into the vacuum chamber while the at least one microfluidic device remains under vacuum.

15 21. The method of claim 20 comprising introducing at least one gas and at least one fluid into the vacuum chamber.

20 22. The method of claim 21 comprising introducing the at least one gas into the vacuum chamber before introducing the at least one fluid into the vacuum chamber.

25 23. A system for filling a microfluidic device with a gas or a fluid, the system comprising:

- 30
- a) a chamber configured to receive the microfluidic device;
 - b) a vacuum source which is fluidly coupled to the chamber and which is configured to apply a vacuum to the chamber; and
 - c) at least one source of a gas or fluid which is fluidly coupled to the chamber and which is configured to introduce at least one of a gas or a fluid into the chamber.

25 24. The system of claim 23 wherein the microfluidic device comprises at least one microfluidic channel.

30 25. The system of claim 23 wherein the vacuum source is applicable to apply a vacuum between about 0 and 102 kPa to the chamber.

26. The system of claim 23 wherein the vacuum source is applicable to apply a vacuum between about 15 and 85 kPa to the chamber.

5 27. The system of claim 23 wherein the vacuum source is applicable to apply a vacuum between about 30 and 70 kPa to the chamber.

28. The system of claim 23 wherein the vacuum source is applicable to apply a vacuum between about 0 and 5 kPa to the chamber.

10 29. The system of claim 23 further comprising a detector which is configured to monitor filling of the microfluidic device with the gas or fluid.

15 30. The system of claim 29 further comprising a processor operably coupled to the microfluidic device, wherein the processor comprises an instruction set for acquiring data from the detector and for controlling filling of the microfluidic device with the gas or the fluid.